10. Group 2

10.1 Properties and reactions of Group 2 metals and compounds

Paper 2

Marking Scheme

Q1.

(c)	$Ca(NO_3)_2 \rightarrow CaO + 2NO_2 + \frac{1}{2}O_2$ **M1** correct formula for calcium nitrate: $Ca(NO_3)_2$ **M2** correct balanced equation	**2**

Q2.

(a)(i)	increases down the group	**1**
(a)(ii)	white solid disappears	**1**
(a)(iii)	CO_2 / carbon dioxide	**1**
(a)(iv)	$Ba(CH_3COO)_2$ / barium ethanoate	**1**
(a)(v)	$Ba + 2H_2O \rightarrow Ba(OH)_2 + H_2$	**1**
(b)(i)	$CaCO_3$ **AND** thermal stability of carbonates **increases** down the group	**1**
(b)(ii)	$BaCa(CO_3)_2 \rightarrow BaO + CaO + 2CO_2$	**1**

Q3.

(f)(i)	magnesium hydroxide / $Mg(OH)_2$	**1**
(f)(ii)	$Mg(NO_3)_2 \rightarrow MgO + 2NO_2 + \frac{1}{2}O_2$	**1**
(f)(iii)	increases	**1**

Q4.

(b)(i)	$Ca(NO_3)_2 \rightarrow CaO + 2NO_2 + \frac{1}{2}O_2$	**1**
(b)(ii)	radium (nitrate) as thermal stability increases down group / has the greatest thermal stability	**1**
(c)	white precipitate / solid (of radium sulfate)	**1**

Q5.

(c)(i)	$Ra + 2H_2O \rightarrow Ra(OH)_2 + H_2$	**1**
(c)(ii)	Ra – more bubbles per unit time **OR** With Ra solid disappears more quickly **OR** Ra is the first to stop fizzing **ora**	**1**

(c)(iii)	**option 1** *suggest why these* reactions *occur at different rates (collision theory)* **M1** difference in activation energy / ionisation energy **M2** affects the frequency of effective collisions (between particles / molecules) **OR** affects the proportion of particles with energy greater than activation energy **option 2** *suggest why the elements have different reactivity in terms of atomic structure (which results in a different rate)* **M1** ionisation energies are different **M2** a decrease in nuclear attraction due to **EITHER** increase in shielding **OR** increase in distance of outer electron from nucleus **OR** increase in number of shells of electrons **ora**	**2**
(c)(iv)	**M1** • pH value (or values) for each solution must be greater > 7 **AND** • pH value (or range values) identified for solution made from Ra must be greater than pH values (or range of values) stated for Ca **M2** *any one from:* • solubility of group 2 hydroxides increases down the group • $Ra(OH)_2$ is more soluble • greater concentration of $OH^-(aq)$ in the solution involving Ra • more OH^- (aq) in the solution involving Ra	**2**

Q6.

(b)(i)	reaction 1 = hydrogen / H_2	**1**
	reaction 2 = carbon dioxide / CO_2 **AND** water / H_2O	**1**
(b)(ii)	$Ba(OH)_2$ is soluble (in aqueous solution) / solubility of Group 2 hydroxides increases down group	**1**
(b)(iii)	thermal decomposition	**1**

Q7.

(b)(i)	$CaC_2O_4(s) \rightarrow CaO(s) + CO_2(g) + CO(g)$ **M1** correct formulae	**1**
	M2 balancing equation AND state symbols.	**1**
(b)(ii)	(thermal) decomposition OR disproportionation	**1**
(b)(iii)	calcium carbonate / $CaCO_3$	**1**

Q8.

(f)(i)	*explain **how the action of heat** is used to identify the 3 samples* **M1** nitrate AND carbonate lose mass / less than 1 g	**1**
	M2 nitrate produces brown (NO_2) fumes	**1**
	M3 MgO no reaction / MgO no change	**1**
(f)(ii)	*electronic configuration of Mg^{2+}* ($1s^2$) $2s^2 2p^6$	**1**

(g)	*One similarity* **M1** solid(s) disappear(s)	**1**
	One difference **M2** $MgCO_3$ fizzes (due to CO_2) OR no fizzing with $Mg(OH)_2$	**1**

Q9.

(a)(i)	hydrogen / H_2	**1**
(a)(ii)	$Ca(NO_3)_2 \rightarrow CaO + 2NO_2 + \frac{1}{2}O_2$	**1**
(a)(iii)	(thermal stability) increases	**1**
(a)(iv)	$CaCO_3 + H_2O + CO_2 \rightarrow Ca(HCO_3)_2$	**1**
(b)	reduces acidity of soil	**1**

Q10.

(b)	*Two reasons why product mixture is added to soil – allow in any order* **M1** Acts as a fertiliser / adds nutrients (for plants) **M2** Neutralise acid soils / increases the pH of acid soil	**2**

Q11.

(c)(i)	**thermal** decomposition	**1**

Q12.

(a)(ii)	$Sr(s) + 2H_2O(l) \rightarrow Sr(OH)_2(aq) + H_2(g)$ **M1** species AND balancing	**1**
	M2 state symbols	**1**
(a)(iii)	**M1** strontium AND forms a more soluble hydroxide	**1**
	M2 strontium hydroxide is a stronger base / produces more OH^- / it dissociates more	**1**
(a)(iv)	(white) **solid** dissolves / effervescence	**1**